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# Activity Report

**Extreme weather events (drought) and its impact on assets,  
livelihoods and gender roles**  
Case study of small-scale livestock herders in Cauca, Colombia

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## Abstract

Research suggests that extreme weather events have a negative impact on agricultural income and wellbeing of smallholder households. Climate change induced shocks can also affect people's ability to work, thereby, influence their decisions on labor or time allocation. Very few studies have considered this impact, mainly at the economy-wide level. There is a huge gap in the evidence of micro level impact of climate change on time-use among agricultural households. In this paper, I analyze the impact of a prolonged weather shock [drought] on labor allocation, primarily time-use of small-scale livestock herders. Adopting a gender lens to the analysis, the paper examines gender differences in the effects of the climate shock. The findings suggest that although both men and women became time poorer as a result of coping with the effects of the drought, women who already managed the double burden of productive and reproductive activities became worse off.

# 1 Introduction

The observable effects of climate change on environment are becoming more and more obvious. Besides increasing temperatures, several extreme weather events like heat waves, droughts, floods etc. are also related to climate change (IPCC 2013; Easterling and Coauthors 2007). Subsistence producers or smallholders are most vulnerable to these effects of climate change primarily due to their dependency on rain-fed agriculture for food production and income generation, as well as their limited capacity to adapt (Morton 2007; Eakin 2005; Feola 2017). Climate shocks, particularly drought is considered as the most constraining factor for agro-pastoralism in the dry regions. It affects livelihoods and household food-security, which is caused by loss of livestock, animals, crops and household assets, falling crop yields, and lower milk and meat production. Research suggests that the increase in the length and intensity of the dry season may have a strong negative effect on agricultural income and wellbeing of smallholder households (Barrios S. and Strobl 2008; Andreas Exenberger and Wolters 2014).

Most of the studies that investigate the impact of climate change on agriculture have mainly considered its effects on production, assets and livelihoods. Climate change induced events also have an impact on people's ability to work and influence their decisions on labor allocation. Very few studies have considered the time-use impact of climate change. Zivin and Neidell (2014) look at the impact of global warming on individuals' distribution of work and leisure, and outdoor and indoor leisure time. Connolly (2018) also looks at similar indicators at the macro level and finds that climate change will affect how people spend their time. None of these studies are at the micro level or consider the impact of extreme events on agricultural time-use.

The aim of this study is to deepen the understanding of the impact of extreme weather events on labor allocation, primarily time-use. I present a case study of small-scale livestock herders in Patía, a livestock intensive region in the department of Cauca in Colombia. I consider people's coping strategies during the period of a severe drought in 2015-16 and how those strategies affected their labor supply and overall wellbeing. Gender dynamics influence the ways in which men and women cope with the effects of extreme weather events. Therefore, this study focuses on documenting gender-differentiated impacts of climate change shocks. The rest of the report is structured as following: in section 2, I describe the data collection methods including intra-household survey and the open-ended interviews; section 3 presents the descriptive results from the intra-household survey and in section 4, I discuss the impact of the drought of 2015-16 on household assets, livelihoods and individual-level time-use; section 5 concluded with recommendations for future research.

## 2 Data and methods

I use mixed methods approach in this paper, combining qualitative and quantitative data from 97 households in the municipality of Patía, a livestock intensive region in the department of Cauca in Colombia. Prior to data collection, in November 2016 I conducted initial focus group discussions in the study site with community leaders and also with small-scale livestock herders to get a glimpse of the socio-economic aspects of the community and its institutions. The results of focus group discussions (FGDs) are available in Arora et al. (2017). The initial qualitative study helped set the research priority within the context of climate change related events and gender, and develop the survey instrument to include this aspect. With the help of a local student in Patía, I conducted the intra-household survey as well as semi-structured interviews with a total of 65 households during October-November 2017. We increased the sample size by

interviewing another 32 households in the same region during May 2018.

## 2.1 Sampling methods

Due to resource constraints, I was unable to conduct a census of livestock producers in the district of Patía. With the help of the municipality officials, I was able to select the corregimientos (districts) within Patía, which are primarily livestock producing. The municipality consists of 24 corregimientos. After a careful consideration of factors like livestock intensive areas, security and accessibility, I selected 3 corregimientos for the survey. Therefore, in no way this study is representative of the municipality or the department of Cauca. It is a case study of small-scale livestock producers in Patía, who are mainly concentrated in these 3 districts. In each corregimiento we randomly selected households and filtered out those that did not raise/herd cattle. The households that participated in the survey are primarily couple-households and their principal livelihood is cattle herding.

## 2.2 Survey description and data collection

The objective of this survey was to collect intra-household data on gender division of labor in all paid and unpaid activities of the household, decision-making and gender norms. In addition, the survey asked household's production of livestock and livestock products, crop or horticultural production, consumption outcomes and impact of previous extreme drought. The qualitative part of the survey included semi-structured interviews on the perception of climate change and the impact of the drought of 2015-16 on their assets, gender roles and division of labor. For each household, we first asked them the filter question - "if they raise livestock (cattle) as one of the main sources of livelihood." The objective was to select households that earn a livelihood from livestock management, even though it may not be the principal livelihood of the household. Once the household passed the filter, we would conduct the household-level survey with both the principal man and the principal woman of the household and later for the intra-household component, we interviewed them separately in order to avoid any biases from the partner. One of the main problems encountered was non-availability of both spouses at the same time, for this reason in many cases we made 2 or 3 visits to the household in order to collect the data. Generally, the quantitative survey was 1.5 hours long including the intra-household module. The qualitative part, that is, the semi-structured interview on the impact of climate change on individuals' roles and responsibilities lasted for about 10-15 minutes with each participant. Once again, the qualitative interviews were conducted separately with the man and the woman. In this study, I will primarily make use of qualitative data and also present descriptive results from the quantitative data.

## 3 Descriptive results

### 3.1 Socio-economic characteristics of the sample households

The majority of the population in Patía depends on agriculture as their livelihood. Livestock is one of the main agricultural activities for the people in the study site. After livestock, horticultural production is the second most important source of income and food security. <sup>1</sup> Table 1 presents the demographic characteristics of the sample households in Patía. About 9.3 per cent of the households are headed by women who are either divorced or widowed. The average

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<sup>1</sup>The principal horticultural crops are fruits including mango, orange and lime.

household size is relatively small in this region. There is an interesting demographic pattern observed in Patía. Most of the households are composed of older adults whose children have migrated to nearby big cities of Cauca and Valle del Cauca departments. As shown in Table 2, the average age of the principal adults in the household is relatively higher in this region, and this is explained by the phenomenon of out-migration of youth to urban areas in Colombia in search of employment.<sup>2</sup>

**Table 1:** Demographic characteristics of the livestock rearing households in Patía

<i>Variables</i>	<i>Average value</i>
N	97
Household size	2.78
Households with young kids under 5 years of age	14.43%
Average distance to the farm	22.6 minutes
Average distance to the market	35.6 minutes
Female-headed households	9.3%

In Table 2, I present the demographic and socioeconomic characteristics of the principal adults, mainly the couple, in the household. The total number of principal women in the sample is higher than that of men because of the inclusion of female-headed households in the sample. Most of female heads of the household are de jure heads who do not have husbands/partners due to separation or death. The average of principal adults is over 50 years, and the average of the principal male adult is slightly higher than that of the principal female adult. Overall, the number of years of education is very low with a marginally higher attainment level among women.

The interesting and stark difference is observed in the principal activities of men and women in this region. Since this is a livestock intensive region, it is obvious that livestock rearing and production is the principal activity of majority of men in the sample. However, among women only 13 per cent reported livestock as their principal activity, when only the sample of couple households is considered, this proportion falls to less than 6 per cent. Majority of women in couple households reported care work as their principal occupation. Among women in female-headed households, livestock rearing is their main livelihood activity.

This pattern of principal activity demonstrates the typical gendered pattern of labor allocation also observed in other regions of Colombia and countries in Latin American, whereby men are primarily responsible for farm and livestock activities (public sphere) and women are primary caretakers of household work (private sphere) (Campana, Gimenez-Nadal, and Molina 2017). This public-private dichotomy is an important dimension of the gendered institutions that define gender identities (Twyman, Muriel, and Garcia 2015; van Staveren and Odebode 2007). As a result, many women farmers do not consider livestock or farming as their principal activity, despite their contribution to the activity. Most often both men and women consider that women are housewives and helpers in agriculture while men are farmers or livestock herders. Given this perception bias, in this study I collected additional information to measure women’s contribution in agriculture, particularly, livestock production. The study asked the female respondents, “Do you have a secondary activity?” If the respondents said yes, the following question asks for the kind the secondary activity. If the respondent said no, the following question asks, “Do you work

<sup>2</sup>Source: FGDs with community leaders: Author’s fieldwork in Patía.

with/help your husband in any kind of livestock or horticultural production during the week?” The data on secondary activity of women reveals that 43 per cent of the women who reported household work as their primary activity work in livestock rearing as a secondary activity or as helpers, and around 25 per cent of them reported horticultural production or home gardens as their secondary activity. Some women also have medium-scale poultry production, yet they consider it as a secondary activity due to sparse income generated from the activity. Overall, close to 70 per cent of the women who reported household and care work as their primary activity are helping in agricultural activities. In order to systematically measure the contributions of men and women to different sectors in agriculture and the household sector, the study also collects time-use data. I discuss the results of intra-household division of labor in the next sub-section.

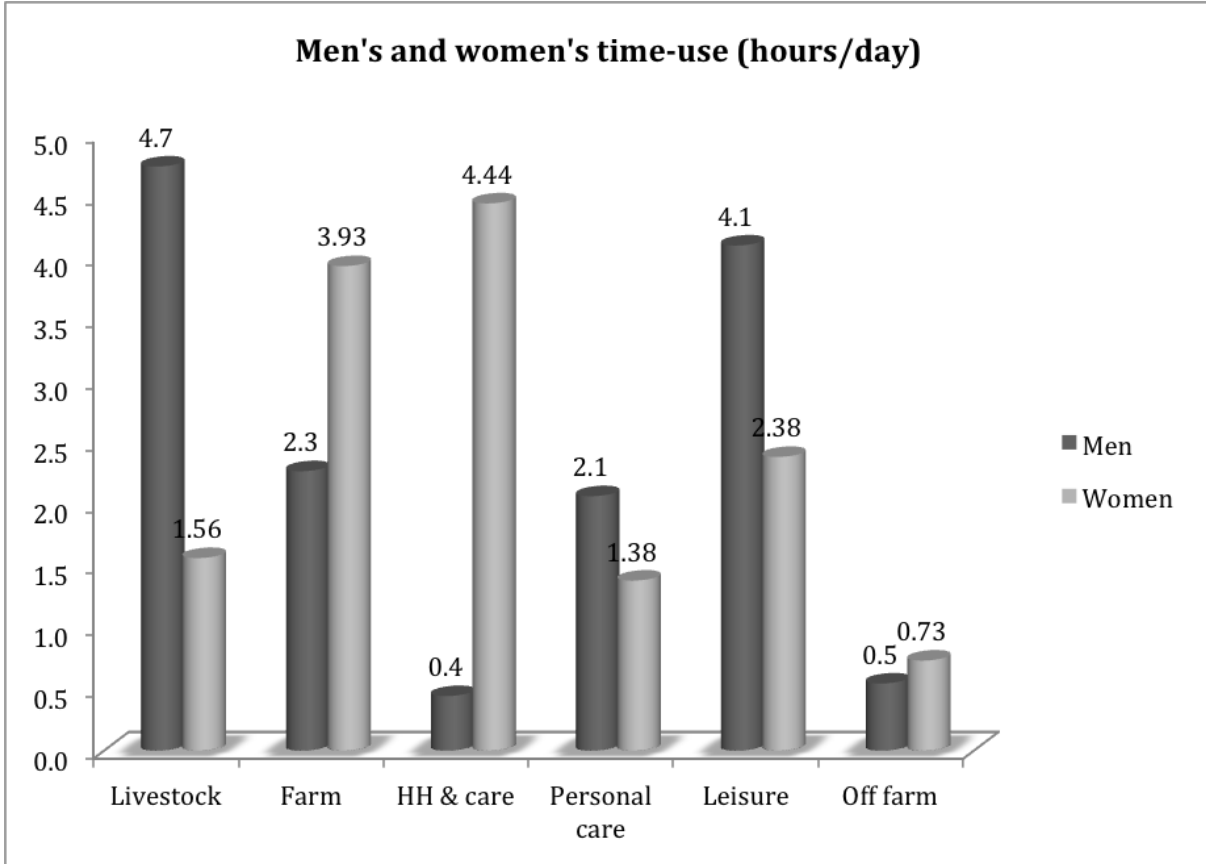
**Table 2:** Demographic and socio-economic characteristics of the principal adults in the livestock rearing households in Patía

<i>Indicator</i>	<i>Man</i>	<i>Woman</i>
N	88	97
Age (years)	53.7	50.6
Educational attainment (years)	5.9	6.5
Religion		
Christianity	95%	97%
Evangelical	5%	3%
Principal activity		
Livestock	79.55%	13.40%
Horticultural production	7.96%	16.49%
Off-farm	10.23%	11.34%
Unpaid HH work	0%	57.73%

### 3.2 Intra-household division of labor

The time-use data from the survey is used to report the gender division of labor between market activities (cattle, small livestock, farming, off farm work), unpaid household and care work, and leisure or rest time. Figure 1 presents men’s and women’s distribution of awake hours across different activities. Livestock activities include both tasks related to cattle and smaller livestock like pigs and poultry. Only for livestock activities related to cattle, men spend around 4.6 hours/day and women spend 0.88 hours/day. Compared to men, women dedicate more time to management and production of smaller livestock, especially poultry. Overall, the gender difference in time spent in livestock rearing indicates that livestock is primarily the man’s responsibility. However, in farm work, which includes horticultural crops like lime, orange and mango trees and patio gardens, women’s labor exceeds that of men. Mostly, the households in the study site have the trees in the backyard or very close to the house. Women reported that it is easier to perform the tasks related to trees and garden crops as being closer to the house allows them to manage household work with these agricultural tasks. The main activities performed by women in farming are applying fertilizers, pruning the trees, collecting the fruit or harvest. The responsibility of household chores and care work provision are primarily the woman’s responsibility with very little help from the man. These results of time allocation are not surprising given strong patriarchal social norms prevalent in this society. Evidence from

other Latin American countries support the results of division of labor observed in this region of Colombia (Campana, Gimenez-Nadal, and Molina 2017).



**Figure 1:** Men's and women's time-use (hours/day)

#### 4 Impact of climate change induced events

The households in Patía experienced a severe drought for almost 2 years during 2015-16. For smallholders dependent on rain-fed agriculture, no rainfall for an extended period of time could result in loss of serious wealth (assets, savings) as well as a probable threat to food security. Lack of rainfall and drought can erode the natural sources of water for cattle and pasture management, which could threaten the health and productivity of animals. The smallholders in Patía during the period of drought in 2015-16 lost their animals, pasture cover and crops due to lack of water and heat waves. About 89 per cent of the households in the sample faced serious damages on the farm, including loss of fruit trees and other horticultural crops, pasture cover and livestock animals. In Table (3), I present the different kinds of damages reported by those affected by the severe drought in 2015-16 in Patía. Most of the households, about 58.76 per cent, lost their cattle in addition to the damage of crops and/or fruit trees as well as pasture cover on their farms. The average number of cattle that died during the drought is 4.5 animals and the maximum number lost is about 20 animals. These results point to substantial loss of assets and earning potential of small-scale livestock herders.

The survey also collected data on the approximate value of animals that died due to the

**Table 3:** Drought related damages faced by smallholder livestock rearing households in Patía

<i>Damages</i>	<i>% of HHs</i>
Only livestock died	5.15%
Only loss of crops/horticultural crops and pasture cover	24.74%
Both loss of livestock animals and crops/pasture cover	58.76%

drought as well as the value of loss of crops/tree and pasture cover. Table (4) shows the value of damages faced by small-scale livestock herders in Patía during the drought of 2015-16. The average loss in monetary terms (here reported in Colombia pesos (COP)) is about 6 million pesos, about USD 2000, for those who lost their cattle due to the drought.

**Table 4:** Value of damages faced by smallholder livestock rearing households in Patía during the drought of 2015-16

<i>Damages</i>	<i>Average Value (in COP)</i>
Loss of cattle	6,081,452
Loss of crops and pasture	259,375

Cattle is not only an important asset for smallholders, it is their primary means of livelihood generation. For many households, the loss of cattle meant serious damage to their income generating potential. For instance, a man aged 61 years who own a small farm with 8 animals in Patía shared that during the drought the creek flowing by his farm dried completely, which was the main source of water for his cattle. In addition, most of his pasture cover dried under the scorching sun and due to lack of rain. He did not have enough money to keep buying concentrates and forages. In a few months, he lost 3 cows and 2 calves, worth more than 5,000,000 COP, about USD 1700. In the following year, his primary livelihood activity shifted to farming horticultural crops like lemon, mango and orange because he had lost several livestock animals and could not continue with the same amount of milk production as earlier. He said, *“It takes a few years to save money to buy a cow or a calf.”* He was worried that the recurring dry periods will make it harder for him to continue being solely a livestock herder and therefore, he said, *“I am trying to diversify my livelihood and my wife helps me take care of the lime and other tress.”* In case of an elderly woman who is also the sole earner in the family and takes care of her sick husband, the loss of her cattle made her more vulnerable to food insecurity. She voiced her distress about longer and severe dry periods in Patía, *“All the pasture dried and there was now water. I lost our 3 cows and a calf, now I have only one cow left. I am too old to find water in the farther regions and cannot leave my blind husband alone for too long. Now I rely on these few lime trees to earn some money to buy staples for my husband and myself. I can no longer afford medication for him.”*

These two examples evince that the impact of extreme weather events is not equal and same for people of different social groups. In this case, we observe that there are differences by gender and income class. The woman who is already poor and vulnerable is left worse off after the climate change induced shock while the man who also was adversely impacted by the event managed to keep his livestock production going and also diversified his livelihood by using his

savings and family labor. In this example, the difference in gender roles is stark because the woman is the sole caregiver in the household and also has to earn a livelihood. She has very limited resources both monetary and labor. However, in the example of the man, despite losing some of his cattle, he is able keep manage his livestock production because he had more cattle and financial resources to buy food for them. He also mobilizes family labor and savings to invest in horticultural crops to diversify his household livelihood. Moreover, it should be noted that he did not have other household responsibilities, thereby, no time constraints between market and reproductive work. I will discuss in detail the impact of climate change and extreme weather events on people’s labor allocation and their wellbeing later in the paper.

Since it was a prolonged drought lasting almost 2 years, with almost no rains in 2015 until end of 2016, when the rains finally arrived in the month of October, the survey asked the respondents how they coped with the drought. Table (5) presents the different coping mechanisms of the livestock rearing households in Patía during the drought of 2015-16. The main coping mechanisms for most households were to use their savings or take out a loan to deal with the immediate losses and expenses. Very few households resorted to selling livestock in order raise money to buy food and water for the cattle. About 20 per cent of the households did not do anything to cope with the drought and waited for it to get over. For example, one couple in the survey said, *“We do not have enough cattle to sell and have no savings to use for water pumps and gasoline. We suffered and prayed that it rains soon.”* This, however, does not imply these households did not take any action to deal with the effects of the shock. Almost all the households that felt the impact of the drought made efforts including made financial expenses, increased time and labor commitment in livestock care or both.

**Table 5:** Coping mechanisms of small-scale livestock rearing households in Patía during the drought of 2015-16

<i>Coping strategy</i>	<i>% of HHs</i>
Sell cattle or smaller livestock	4.65
Take a loan	26.74
Use savings	48.84
None	19.77

Now, I will discuss the major actions taken by the households in order to cope with the effects of the severe and prolonged drought of 2015-16. The proportion of households adopting different actions is presented in Table (6). About 50 per cent of the households took more than one action to mitigate the impact of the drought on their crops, livestock and pasture cover. Some of these actions lead to additional expenses for the households. For example, those who bought the water pump spent on an average 1,000,000 COP, 350 USD plus additional costs of gasoline required to run the pump; others who rented or borrowed it from their neighbors still had to incur the costs of gasoline. Also, some households bought feed for the cattle like concentrates, forages etc. Wealthier households or parents whose children sent remittances were able to hire labor to perform several of the laborious actions mentioned in Table (6).<sup>3</sup> In order to cover these additional expenses, households used their savings, or borrowed money, or sold livestock. Some households started small self-employment projects to make additional income to finance the expenses of livestock care and management. For example, one of the respondents,

<sup>3</sup>The cost of hiring labor is 30,000 COP, about 10 USD, per day.



a man aged 55 years shared his coping strategy as, “*I borrowed a water pump from my uncle’s farm and also bought honey and concentrates for my cattle every week. My wife started baking and selling bread to help cover these expenses.*” In another case, the woman in the household said, “*I collected totumo (fruit of calabash tree), cleaned it and sold it for money so we can buy some salt and concentrates for the cattle.*”

**Table 6:** Actions taken by smallholder livestock rearing households in Patía during the drought of 2015-16

<i>Coping measure</i>	<i>% of HHs</i>
Buy water pumps	37.20
Buy concentrates and other foods for the cattle	20.93
Dig a water reservoir	55.81
Herd the cattle in other farms/ rent land with better pasture resistant to drought	10.46
Use tree leaves as feed for the cattle	22.09
Hire labor	10.5

Not all the households spent additional expenses on livestock management in order to cope with the effects of the drought. Many households resorted to actions like digging a water reservoir, or collect fresh leaves of trees to feed the cattle, or herd the cattle on farms or spots with pasture, oftentimes in areas farther away from their own farms. The last measure in some cases also required payment of rent on farms with good quality pasture resistant to drought. Altogether, these coping measures increased the demand for labor in livestock rearing and production activities. The livestock holders in the study site responded to the increased labor demand by making changes to their time allocation across different productive, reproductive and leisure activities. Even though men are more active in livestock care and production activities, the drought and its effects on the farm altered labor allocation of men and women both. I analyze the qualitative data from the open-ended questions on “what actions did the men and women in the household take to cope with the effects of the drought and how did those actions affect their workload and usual responsibilities.” About 80 per cent of men and 65 per cent of women in the sample reported changes in their time-use in order to undertake additional measures, primarily increased workload on the farm, to cope with the effects of the drought. Among the female-headed households, all the women reported substantial increase in their workload in livestock feeding and management activities.

Given fixed number of hours in a day, increased labor time in one activity requires time trade-offs with other activities and/or lesser leisure or rest time. This phenomenon of changes in time-use or time trade-offs between activities is commonly observed among farmers, e.g. seasonal variation in labor requirements on the farm. However, in this study, people report their struggles to respond to the drought by working longer hours and often working in strenuous activities in livestock management. In general, for men in the sample, the trade-off was between the tasks related to different measures to manage their livestock during the drought and leisure time. On an average, men reported working 2-2.5 hours more per day in tasks like herding the cattle to places with water and pasture, cutting leaves and tender tree branches to feed the cattle, transporting water to the farm, making visits to the market to buy feed for the cattle etc. Most men who reported increasing labor in livestock activities during the drought had to reduce their leisure time, i.e. leisure activities and rest time. They reduced the number of hours of sleep and

often, would wake up before the crack of dawn to avoid scorching heat of the day and to find feed for the cattle or transport water to the farm. In Box 1 I present the anecdotal evidence from the qualitative study, which describes the struggles experienced by men livestock herders to cope with the effects of the prolonged drought in Patía during 2015-16.

**Box 1: Men's experiences of adopting additional measures to cope with the effects of the drought in Patía**

*I worked double as hard as normally in order to collect water for the cattle and inspect their health since they were more vulnerable due to lack of sufficient food and water.*

Luis

*I had to walk to other farms and fields to cut pasture and sugarcane for the cattle. Some days I walked more than 2 hours just to find feed for the cattle. Each day I worked at least 3 hours more than normal. I worked hard to keep my cattle alive. I had no time for rest.*

Mario

*My wife and I collected water in buckets from the big river and transported it to the farm on my motorbike. We made at least 5-6 trips a day. I did not like doing this since it was very risky for my wife to hold a big and heavy bucket of water on the motorbike, but we did not have other options to keep our cattle alive.*

Julio

*In order to pump water in the farm, I transported the water pump everyday from my house to the farm. I tied the pump to my motorbike and slowly rode to the farm everyday and then transported it close to the creek to pump put water for the pasture and water tank for the animals. I spent more time on the farm to look after the cows.*

Guille

*I took my cattle to the creek where the water was still flowing during the drought. Because we shared the creek with other herders, everyone went at different times of the day. I walked 1 hour each side with the cattle in extreme heat under the sun.*

Esteban

*I woke up early everyday to take salt to feed the cattle, and then worked in the farm pruning the lime and mango trees. Often I asked my wife to help me collect leaves and small fresh branches to feed the cows.*

Santiago

*My cattle did not produce enough milk due to lack of food and water. I worked as a farm laborer to make some money for household expenses. Each day, I worked 2-3 hours extra just to collect forage or cut sugarcane or leaves as feed for the cattle.*

Ismail

*When it did not rain for several weeks and the pasture started to dry out, I dug a reservoir to pump water in it and use the pipes to irrigate the pasture and also use it for the cattle. It took 4-5 hours of work each day for almost 2 weeks to make these arrangements.*

Jairo

All these anecdotes illustrate that the drought adversely affected men’s workload related to livestock management and care. It is not possible to comment directly on the exact changes in individuals’ time-use during the circumstances of the drought. Since the recall period was too long it was not meaningful to collect time-use data for the period of the drought. Nonetheless, the anecdotal evidence indicates that some of those extra hours of work came from men’s leisure time and also by extending the number of awake hours. We can infer that men became time poor managing additional activities in livestock during the period of the drought, i.e. worked longer hours with lesser time to recuperate.

Although men faced difficult choices between additional work and leisure time, they didn’t have competing claims on their time from other responsibilities of household and care work; as shown in figure 1, men’s involvement in household chores and care provision is minimal. For women, however, their time is divided between productive and reproductive activities. Even though women are not primarily responsible for livestock rearing, their contribution to livestock production, direct and indirect, is important. As discussed earlier in the paper, livestock management is a secondary activity for many women, about 43 per cent. Also the time-use results show that women supply labor to different cattle management activities. Women are also active in tasks related to milk processing, thereby, generating a new product for sale. The evidence from a previous qualitative study (Arora et al. 2017) and the anecdotal evidence presented above shows that women also support the livestock sector by contributing to the direct expenses in livestock production activities like selling bread to buying feed for animals. Regardless of women’s direct involvement in livestock sector, their indirect contribution through unpaid care work that leads to the production of well being of household members is crucial, and without it the production in livestock sector cannot be sustained. These factors motivate the importance of considering women’s experiences and struggles during the drought, even though they may not be primary workers in livestock activities.

Fewer women than men (65% vs. 80%) reported major changes in their time-use during the drought. There are possibly two main reasons for this result. First, the women who are employed off-farm, about 12 per cent of women in the sample, were not able to shift time from wage work to help their husbands in livestock activities. Nevertheless, they felt the pressure to cram some of their chores in a short period of time, usually early mornings, in order to take care of needs of their husbands and children. For example, Maria who works in a kindergarten as a cook shared her experience, which illustrates this point; she said, *“During the drought or in dry season in general, things are tough. My husband worked very hard to find food and water for the cattle. I was unable to help him except on Sundays. My work brings steady income, which we desperately needed during the drought when the milk production was low and often we had to buy supplements for the cows. He leaves early in the morning. Often, he is unable to come home for lunch, so I have to prepare breakfast and lunch very early in the morning.”* Second, in majority of the households that hired labor for help with the additional measures like dig a reservoir, herd cattle in other farms, to cope with the effects of the drought, women did not alter their time-use. In some cases, though, women were responsible for preparing food and bringing it to the farm for their spouses as well as the hired workers.

Now I consider the experience of women who reported being overwhelmed due to additional work related to livestock management during the period of the drought in 2015-16. What were the additional tasks that women undertook during the period of the drought? Did they make any trade-offs between household and livestock/farm activities? How did they manage the competing claims on their time? In the qualitative study, I explored these questions with all the female participants in the survey. Table (7) shows different tasks undertaken by women to help their husbands in livestock and farm activities during the drought. Majority of the women helped

their spouse in transferring water from the creek or the reservoir to the animals, and collect tree leaves and/or cut sugarcane/pasture to feed the animals. The category of others includes tasks that indirectly supported livestock activities like collecting *totumo* for sale, buying milk to process cheese for sale and working as farm laborer to earn income to buy food for the cattle. It is important to emphasize that all the activities in Table (7) are time-consuming and intense. Women performed these activities almost on a daily basis during the period of the drought along with their household care work responsibilities.

**Table 7:** Women’s tasks in livestock rearing during the drought of 2015-16 in Patía

<i>Tasks</i>	<i>% Women</i>
Help with transferring water	34.48
Help with digging the reservoir	1.72
Prepare and transport food for hired laborers	12.07
Herd the cattle in other farms	6.90
Collect tree leaves for cattle feed	24.14
Help with feeding the animals	10.34
Purchase and transfer cattle feed & supplements	3.45
Others	6.90

Compared to a typical day for women in this region, as shown by time-use data in Figure (1), the activities undertaken by women in the livestock sector during the drought, presented in Table (7), certainly burdened them with additional work. I present anecdotal evidence from the qualitative study, which supports this claim. The anecdotes in Box 2 evince women’s coping mechanisms and strategies to deal with the effects of the drought. It is certain that each individual’s struggle is unique, however, in the analysis of the qualitative data, I found that there is similarity in the kinds of coping strategies pursued by women during the drought. In order to avoid repetition, I present the evidence that captures the essence of women’s struggles of managing livestock and household care activities during the drought.

**Box 2: Women's experiences of adopting additional measures to cope with the effects of the drought in Patía**

*I had to give up household chores in the morning in order to transport water in buckets for the cattle. The household work used to get accumulated that I had to take care of during the evenings. I worked at least 3 hours more per day to complete all the tasks.*

Luisa

*I helped my husband to find leaves and new tender branches of tress to feed our cows. I helped my husband with milking the cows and also transported a part of the milk back to the house in order to process it into cheese. Normally, my husband used to bring the milk. During the dry season, however, he works longer hours in the farm, so I have to take up some of his tasks. I still cooked all the meals and at times, took food for him to the farm. I was working much more during the drought, 3-4 hours/day.*

Maria

*In order to help my husband with transporting water from the creek to the water tanks on the farm, we often left early in the morning and worked till late without food. Later, I would come back to the house to manage household chores like cleaning, looking after the lime trees in the garden and to cook food and take it to the farm for my husband.*

Alejandra

*Often, I would gather mango, and leaves from calabash trees to feed the cattle. Collecting these would take me over 2 hours every day. The drought was a very difficult period for us. We worked more than normal only to survive.*

Ana

*Lack of water made it too difficult to perform household tasks and also to feed the animals. I fetched water in the creek to use it for cleaning, washing and feeding the chicken. My poultry business suffered a lot because the chickens were not laying as many eggs and some died due to lack of food and water. I worked very hard and had no time to rest. I could not sleep well due to the stress of finding water the next day.*

Lucia

What's evident from the anecdotes in Box 2 is that these women were facing competing claims on their time, which meant that they make trade-offs between household and livestock related activities. Most of them were working longer hours and had lesser time to rest and recuperate. Many women stressed that the double burden of unpaid household work and livestock related tasks impacted their health and wellbeing. For example, Maria voiced her distress in the interview, "*all the work on the farm, collecting leaves and fetching water for the cattle was in addition to my household responsibilities. I worked 3-4 hours more to manage everything. I suffered from back pain and headaches. If I didn't help my husband with feeding the cattle, we may have lost some of them.*" These results demonstrate the impact of climate change induced shock on time-use of women, who are not considered to be the primary actors in the livestock sector in this region. During the drought women's contribution to the livestock sector was substantial and significant, despite their commitment to the household care provision. These findings indicate that extreme weather events not only affect livestock production, they have a considerable impact on labor allocation of smallholders and this effect is not gender neutral.

## 5 Conclusion

Climate change is expected to have several adverse effects on agricultural systems across the globe. Greater uncertainty surrounding rainfall and more frequent drought are already affecting smallholders' ability to earn a livelihood. In this study, I considered the impact of a severe drought on small-scale livestock herders' livelihoods, assets and labor allocation. One of the primary questions asked in this study is - How do small-scale livestock herders respond to extreme weather events? To answer this question, I consider responses of men and women in small-scale pastoral households in Patía in the department of Cauca in Colombia. The findings of this study indicate that prolonged dry seasons and heat waves cause considerable losses for these livestock owning families. They lost livestock animals due to lack of food and water, their crops and pasture cover dried substantially. Many households made investments in technology like water pumps and reservoirs by drawing upon their savings and/or taking a loan. Poorer households without any savings and ability to borrow took various actions to keep their livestock animals alive. Most of the actions undertaken to cope with the impact of the drought were labor intensive and increased the demand for labor in livestock related activities. The effects of managing the actions related to coping strategies along with usual tasks in farming, livestock production and household care provision were unequal for men and women. Although men faced difficult choices between additional work in livestock care and leisure time, they didn't have competing claims on their time from other responsibilities of household and care work. Men who are principal care takers of livestock worked longer hours with lesser time to recuperate. However, women who are primarily responsible for household chores and care work managed these activities in addition to helping their husbands with several tasks related to livestock and the actions related to coping with the drought. For women the effects not only increased the workload, they faced competing claims on their time, which many women dealt with by making trade-offs and/or working longer hours. In a way, both men and women became time poorer as a result of managing the effects of the drought. Nevertheless, women who already worked more than men (as shown in Figure 1), in productive and reproductive activities, became worse off.

This study is based on a particular study site and time, and therefore offers limited basis for generalization. However, the results of this study point at an important research endeavor for future studies - assessing the impact of climate change and related events on time-use or labor allocation in agriculture. Most of the previous studies have considered the impact of extreme events on production and macroeconomic indicators. It is important to understand the relationship between climate change and time-use or labor allocation decisions in order to fully capture the impact of climate induced events on production, which includes labor supply as one of the main inputs. Recent macro-level studies by Zivin and Neidell (2014) and Connolly (2018) considers the impact of climate change on time-use. The results show that rising temperatures have the potential to reduce the time spent on working, especially in high-exposure industries and leisure time outdoors. The results of these studies along with the evidence presented in this paper offer a case for further investigation of the impact of climate change on time-use among small-scale agricultural workers, who primarily work outdoors and have limited capacity to adapt to the effects of climate change.

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